

CUBES TO COLLABORATION: A GENERATIONAL DIVIDE IN THE  
WORKPLACE

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by

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## ABSTRACT

The purpose of office space has evolved. As the workforce transitions from the baby boomer to the millennial generation, companies are changing their approach to collaborative spaces for knowledge work. Yet, expectations of an ideal workplace differ between cohorts. This study investigates the behavior and perceptions regarding collaboration space held by employees at The Boeing Company. An effort is made to consider the larger organizational ecology. Methods include observations, interviews, and a survey. Results show that there is a generational divide in perception and space use. Facilities should be strategically used as an asset to bridge this divide by aligning change management processes and participatory leadership techniques with workplace design.



## BIOGRAPHICAL SKETCH

Megan Cackett grew up in upstate New York, in the suburbs of Rochester. Her first introduction to strategic problem solving was as a competitor in the NASA sponsored Odyssey of the Mind program, which she competed in for nine consecutive years. Megan spent two years studying Integrated Marketing Communications at Ithaca College and completed her undergraduate coursework studying Design & Environmental Analysis at Cornell University. Megan's work experience has primarily been in the aerospace industry, strategically planning, designing, and evaluating facilities. Additionally she has explored areas of research in both ergonomics and digital technology, with a goal of finding the intersection between these topics and design. Megan's interest in workplace strategy is in the global impact that the office environment can have on the population and the relevance of this topic as the landscape of the workplace is changing now more than ever, providing an opportunity to innovate through design.

Dedicated to Brenda and Steve Cackett

## ACKNOWLEDGMENTS

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## 1. INTRODUCTION

The workplace blueprint is transforming due to a generational shift in the workforce and the changing purpose of the workplace. As the millennial generation matures and the baby boomer generation approaches retirement age there will be a substantial shift in the working population. Estimates based on population and average retirement age show that approximately 10,000 baby boomers retire each day and 4 million will retire each year for the next twenty years (Kessler, 2014). Larger companies invest millions of dollars each year to recruit, hire, relocate, train and develop new employees to fill these positions, which is not only costly but also critical to maintaining the overall success of a business (Bliss, 2004; Guthridge, 2008). Additionally creating a smooth knowledge transfer between these generations is essential in driving innovation and allowing companies to remain competitive in today's increasingly global markets while they undergo this workforce transition (Santos, 2000; Sheridan, 1992; Sveiby, 2002).

At the same time, the purpose of coming into an office continues to evolve due to a variety of driving factors. Historically, the purpose of coming into work was to be at a place where an employee works closely under the supervision of their boss; they have access to technology stationed at their desk that is superior to the technology found at home, and work hard each day in hopes of moving up the corporate ladder. This was traditionally seen as a path towards upward mobility and was closely reflected by the square-footage of an employee's assigned office (Saval, 2014). There are still plenty of workplaces that operate this way, however cultural factors and the

accessibility of digital technology have driven office space use in another direction. Now there is growth in the role of the knowledge worker and value of face-to-face problem solving and team-based work (Becker, 1995; Cross, 2016; Chui, 2017). With the capability to work independently from anywhere, there is an expectation that now the purpose of coming into an office space is primarily to meet with other people and take advantage of the resources and amenities provided at that location. Expectations of office space ownership have loosened with the development of workplace strategies designed for collaboration and flexibility (Action Office, 2017; Activity Based, 2012; Congdon, 2014; The Future, 2015; O'Neill, 2011).

In response to these changes the technology industry has led a movement towards reimagining the workplace. Tech companies like Google, Facebook, and Apple transformed their workplace environments in the early 2000s, reflecting the value of community building at work by providing services, amenities, and collaborative spaces in their facilities (Technology, 2017; Belton, 2015). Similarly, the growth of the co-working business model reflects the same values of community, flexibility, and knowledge-sharing through collaboration (Desai, 2016; Explore, 2017; Kreamer, 2012; Schneider, 2017). One co-working company, WeWork, has over 100,000 members and opens 10-20 new buildings each month (Shannon, 2017). Other companies like Yahoo have created company-wide policies stemming from the value of face-to-face collaboration such as requiring employees to work in the office rather than work from home (Miller, 2013).

These two phenomena, the generational shift in the workforce and changing physical landscape, have been studied separately but should be thought of together due



to the widespread impact and common driving factors for each. The cost of facilities and real estate is the second highest cost for a business, second to employees, and the evolution of work has led companies to begin to consider how to cut costs while also using facilities as an asset (Apgar, 1995; Earle, 2003). Companies throughout different industries are investing in workspaces in order to gain the benefits of a collaborative workforce and to foster the creativity, innovation, and teamwork that drive profits (Clark, 2007). It is essential to understand how different generations respond to these physical changes in their work environment to help a smooth generational transition take place and to update the baseline for workplace design and management. Generational and workplace changes run parallel, and influence and are influenced by one another. Both generational and workplace changes are driven by overarching cultural, technological, social, political, and economical factors. However, there are few studies looking at these two constructs together.

This thesis examines how employees of different generations use and perceive a collaborative space in a work environment. Due to the nature of this topic, it is necessary to understand a variety of organizational, facility, and individual factors in order to construct a vivid picture of the relationship between people and place in the greater organizational ecology. As a result the theoretical approach guiding this research emphasizes the importance of considering the holistic impacts of these factors. This research applies a case study methodology to measuring and analyzing a collaborative space called the Engineering Career Development Center (ECDC) in The Boeing Company. The findings from this study will support Boeing to make research-based decisions for future facility improvements while considering the

connection between employees and their work environment. Additionally this research will contribute to the existing body of environmental psychology research, building a stronger connection between generation and the physical workplace.

## 2. LITERATURE REVIEW

There are few previous studies that mention the relationship between generational differences and collaborative spaces in the workplace. As a result, this literature review explores previous research on generational differences in expectations, separate from research on collaborative spaces in the workplace. In each body of research, the underlying themes and gaps that my research is filling are identified. Additionally Becker's theoretical lens is introduced as an explanation of the theoretical framework for this study (Becker, 2007).

### 2.1 Generation

In today's workspaces it is common to find millennials, Generation Xers, and baby boomers working side-by-side. Each generation is linked to a set of values that often results in differences in workplace expectations and behaviors (Bennett, 2012; Clark, 2007; Elder, 1979). Research shows that differences in workplace expectations are shaped by generational cohort, stage in the life cycle, and industry or career (Elder, 1979). Researchers have presented solutions that support these differences in expectations, which include implementing human resources initiatives, changing to management styles, and designing improvements to the work environment.

The historical context in which an individual grows up links them to a generation and a set of values that often result in differences in workplace expectations and behaviors (Elder, 1979). Researchers have cited that baby boomers, born between 1946-1964, grew up during a tense political environment, straddling ideals of war and peace during the Vietnam War. At that time culture was changing due to factors including: the widespread access to television, the rise of the Beatles, and an economic

recession that occurred during the time when many individuals of this generation were first seeking jobs (Clark, 2007, Santos, 2000). Researchers have found these events helped shape a generation of people that value privacy and personal space in their workspace, and are optimistic and driven at work. Others have cited that employees in this generation are more likely to place value in their physical space and long-term achievements, like working for a corner office over the length of their career (Bennett, 2012; Clark, 2007). Generation Xers, born between 1965-1978, share some similar workplace expectations despite different historical influences. Generation Xers grew up with the influence of political events surrounding the Cold War, a shift in pop-culture to embrace Rock and Roll, and a reputation for being known as the “latchkey” kids who would let themselves into their houses after school without supervision (Clark, 2007; Bennett, 2012; Guthridge, 2008). In a professional setting Generation Xers are often independent and value personal space similar to the baby boomer generation, yet they are seen as more adaptable and flexible to situations in the workplace. They have a strong emphasis on work-life balance (Bennett, 2012; Joy, 2011). In contrast, the millennial generation, born between 1979-2000, has been characterized primarily by technology changes rather than social and political factors. Millennials grew up in a time where mobile devices have developed rapidly and are now fully integrated into society. Some say this generation has been constantly rewarded from a young age and that therefore at work they expect praise and recognition (Bennett, 2012; Clark, 2007; Guthridge, 2008; Santos, 2000). Some researchers suspect that because the millennial population grew up during the 2008 recession they may tend to be more conservative with spending habits, and will choose

to spend money on experiences more than consumer products (Pirie, 1998). Their workplace expectations include having control over their environments, having a natural tendency to collaborate with coworkers, moving up quickly in their career, having large responsibilities at an entry level position, and an integration of work and life (Bennett, 2012; Myers, 2010; Glass, 2007).

In addition to generational differences in values and expectations, there may also be a natural shift in an individual's expectations depending on their life cycle stage (Elder, 1979, Erikson, 1994; Neugarten, 1976). Researchers have found that human expectations change throughout the life cycle as the individual's roles change. Theories supporting this thought include Erikson's life stage theory, and the life-span development theory (Erikson, 1994; Elder, 1979). For example, some findings show that, at least in western cultures, the 20's are for exploration, mid 20's to 30s for becoming more established, and 40's and on for maintaining individual roles both at work and home until decline (Super, 1980). Similarly, as a young adult there is a high value on independence and social support from friends and family, while in later adult years there is a transition to focus on cognitive fitness, health, and reflection, with support from a spouse, family or friends (Baltes, 1980). Career-wise young adults are focused on achieving success, happiness, and career accomplishments, while adults nearing retirement are focused on contentment, good health, and the ability to accept change (Baltes, 1980). There may continue to be natural divides in workplace expectations due to life cycle expectations beyond the current generational transition.

Generational differences in expectations are critical to understand because these differences may cause conflicts in teams, create barriers to knowledge-sharing

between generations, and lead to challenges in attracting and retaining new employees (Sveiby, 2002, Watkins, 2005; Argote, 2000; Leiter, 2009). The consequences of failing to address these concerns in a workplace can lead to low employee satisfaction and engagement levels which has been found to be closely associated with employee turnover rates as well as employee burnout (Leiter, 2009). Companies must account for these issues to ensure that generations work together effectively in the workforce, in order to remain competitive in the global marketplace.

Proposed solutions to bridge the gap between employees of different generations have focused on policy improvements implemented through human resources and management strategies. Human resources strategies include developing targeted value propositions for different generations, and taking ownership of attracting new talent to fill the knowledge gap (Clark, 2007; Guthridge, 2008; Rosenstein, 2002). Some researchers believe human resources should tailor employee benefits to each generation by implementing initiatives like wellness programs for baby boomers, policies encouraging work-life balance for Generation X, and a reward system for millennials. When it comes to intergenerational conflict, human resources might focus on socializing employees, setting standards for organizational culture, and creating a reward system for intergenerational teams that work well together (McGuire, 2007; Watkins, 2005).

Managerial approaches are similar to human resources strategies, the key difference being that practices and policies are passed down vertically in the organizational hierarchy from one employee to another. Some researchers say the first step managers can do to manage intergenerational teams is to understand individual

differences in work styles and opinions and to be aware of these differences going into each project. The next step would be to build mentor-mentee relationships and reward staff that work well together (Dols, 2010; Glass 2007; Jacobson 2007). Throughout this process some believe it is a manager's role to set the tone for what language is acceptable, helping to alleviate and eliminate offensive word choices or behaviors related to ageism (McCann, 2002). Other researchers have found that the role of these managerial mentorships is related to workplace satisfaction. Employees with a good relationship with their manager reported being more satisfied with their jobs and more willing to remain in their positions (Wieck, 2010). Leadership guidance and the method of managerial communication can help shape an employee's perception of the hierarchy within the company and contribute to building a healthy organizational culture (Glass, 2007).

Despite the widespread practice of these strategies, these approaches often do not consider the synergistic impact of how policies, employee perception and behavior, and the environment, come together. Some researchers place the responsibility of mitigating generational differences entirely on the human resources department, which can be viewed as a reactive approach to solving problems once they arise rather than preventing conflict. Similarly, researchers outlining managerial solutions often do not acknowledge how management is one of many departments and aspects that an employee interacts with. Human resources and management should be thought of together, especially when issues like age discrimination occur. Additionally there is minimal research on generational differences related to the physical work environment.

## 2.2 Collaboration Spaces

The growth of collaboration spaces in industry and as a topic of academic research is a separate entity from the topic of generational research. Collaboration spaces have become a popular term in businesses throughout the last decade, stemming from the generally accepted benefit of having employees collaborate to contribute to business success. As a topic collaboration has increased in popularity by 4.6% over the last eight years (Explore, 2017). Collaboration spaces became popularized with the growth of the tech industry, as these industry leaders reinterpreted what the workplace could look like.

The design of these spaces in industry looks different to each company yet common design characteristics can often be found in each. Based on an analysis of the top 399 Google image results for ‘collaboration spaces’ (revealed based on relevance tied to keyword search, longstanding history of the image, and the quantity of other websites that are linked to that image) 96% of the images portray a shared table with chairs to accommodate multiple people, 82% are placed in a room with a few bold accent colors, 26% include a surface that can be written on, (i.e. chalkboard, whiteboard, glass walls) 79% have natural light in the space, and 37% have a non-traditional architectural design element, this includes elements in the space that appear to be designed for a purpose rather than placing a table and chairs in a rectangular room (green wall, foosball table, designer chairs, etc.). The search contains images of diagrams and furniture pieces as well (Figure 2.1).





Figure 2.1: Typical Collaboration Space Design Characteristics

Generally, the amount of time spent on collaborative activities differs between industries. Results from Gensler's U.S. Workplace survey for technology and for government reveals how top performing companies in those industries are collaborating and using their workspaces. Government companies generally spend about 30% of their time each week collaborating face-to-face, and about 12% collaborating digitally, a majority of time is spent on independent focus work 51%, and learning and socializing 7% (Figure 2.2). These results were similar for employees in technology industries (U.S. Workplace, 2016).

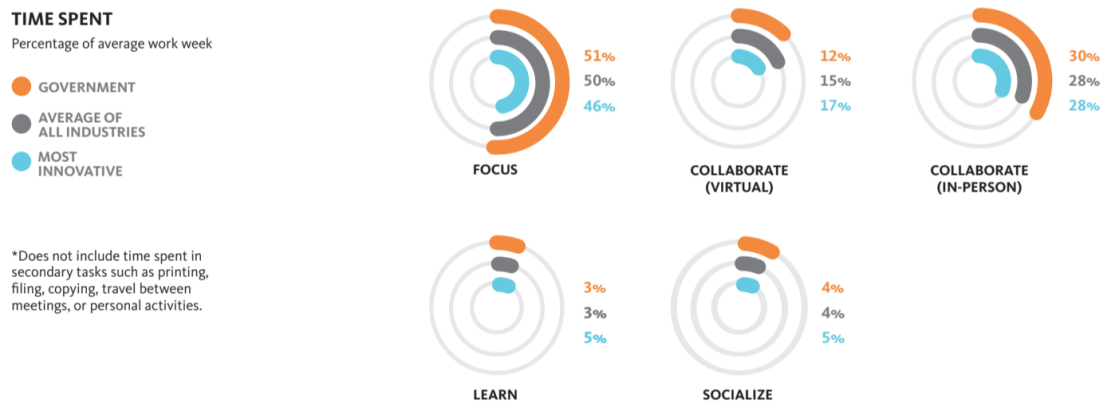


Figure 2.2: Gensler US workplace Survey Data (U.S. Workplace, 2016)

Government and technology employees rated their work environments to have a low level of choice and low level of job satisfaction compared to the benchmarked top level companies. Additionally workers in both spend a majority of their work day in their individual primary space compared to conference rooms, collaboration rooms, or at home (U.S. Workplace, 2016). In contrast, companies specializing in design strategy are also recognizing the benefits of using the workspace as an asset, yet rarely highlight generational differences.

Companies specializing in design strategy highlight positive outcomes of collaborative spaces such as increased communication between employees, greater employee engagement, and the growth of a healthy organizational culture, among others through strategies and products they sell (Action Office, 2017; Changing, 2015; Cross, 2016; The Future, 2015). These firms are constantly identifying and creating the next workplace strategy and products to implement throughout their client companies globally. Other strategies to increasing collaboration at work include the “activity-based workplace” which is a popular workplace design solution that

highlights the importance of providing choice and multiple settings in order to accommodate for the range of tasks happening in the workplace (Action Office, 2017; Congdon, 2014). Despite the rise in collaboration spaces, little research has examined the relationship between the physical environment and generational differences in space use and perception.

In previous academic research, studies have focused on quantifying positive outcomes of collaboration spaces in terms of general employee preference and perception, which approach a similar area of interest. Research has found that adjacencies and proximity of the building location, as well as the relationship employees have between their primary workspace and collaboration space may play a role in the overall perception of a collaboration space. Employees preferred collaboration spaces that were located away from their primary workstations (Haner, 2005; Oldham, 1996; Oseland, 2011). However, research has found that perceived collaborative support was highest when collaboration spaces were in close proximity to primary workstations. In these cases, there is a clear distinction between an employee's primary workspace and the collaboration space. Value perceptions are also higher when spaces are on the corners of the floor plate as opposed to being one centrally located space. This has implications in how employees may perceive the level of support differently based on differences in layout (Hua, 2010). However, other researchers point out possible confounding factors to how people are using their workspaces, which include individual personality differences, unique self-schema, and internal motivations (Oseland, 2009; Prince, 2004; Seddigh, 2016; Webb, 2008).

There are no strict guidelines for how a collaboration space should be designed, however, some researchers have determined successful underlying characteristics of spaces based on their studies. Oseland includes proximity to other shared amenities, accessibility, privacy, and functionality as the key design characteristics for success (Oseland, 2011). Research examining creativity found that employees produce the most creative and valuable work with paired with a supportive supervisor in a challenging environment (Haner, 2005; Oldham, 1996; Oseland, 2011).

Even with the rise in collaboration spaces in the workplace, there is still a relatively small body of research on these spaces. Literature on the impact of collaborative spaces in the workplace often focuses specifically on human responses to collaboration spaces without describing and defining the physical environment that is being studied. Additionally, there is a difference between what is happening in industry and what is happening in academics. Companies specializing in workplace strategy often do not test their strategies using a formal academic research procedure. Once these strategies are implemented within a company, it is even more rare for them to be evaluated and published in peer reviewed journals. This creates a gap of understanding between theory and practice that is worth exploring through a case study approach.

### 2.3 Generation and Collaboration Spaces

There are few studies on the relationship between generational differences and the work environment. Research has pointed to theoretical improvements and the beginnings of different preferences in space typologies, as well as studies on intergenerational spaces. Despite the similar goals of intergenerational spaces and

collaborative spaces in the workplace, intergenerational spaces focus primarily on the two extremes of the population: children and elderly, while, in the workplace the generational age range is less extreme. Intergenerational spaces are referred to as community spaces and have not been applied to work environments. Additionally, some researchers report that there is a lack of evidence to back claims of the effectiveness of current implemented models of intergenerational spaces, primarily those located in shared urban spaces (Kaplan, 2007; Melville, 2013).

Researchers have proposed that the physical environment can be used as an asset to encourage knowledge-sharing across generations. Researchers theorize that collaboration spaces provide opportunities for employees to learn from each other through informal conversations about different projects (Bennett, 2012; Earle, 2003; Richman, 2008). Beyond theoretical claims there is minimal research on the outcomes of collaboration spaces and generational differences. A case study conducted in the UK found that baby boomers preferred bookable meeting rooms for scheduled meetings while millennials preferred an open atrium space. Additionally, employees of all generations reported that they felt they had the most effective knowledge-sharing in team-based areas designed with four desks together in an open office layout (Joy, 2011).

Some researchers have investigated the role of intergenerational spaces within education facilities, healthcare living facilities, and shared spaces in urban areas where the populations of interest is young children and elderly adults (Kaplan, 2007; Melville, 2013; Thang, 2013). Scholars argue that these spaces are important because they provide opportunities for both the elderly and children to share ideas and learn

from each other through positive, engaging experiences (Thang, 2013; Kaplan 2013). Other researchers point to the greater significance of how these spaces will lead to a more unified society as we integrate all ages of the population to function more productively as a society (Melville, 2013). Yet the policies on integrating intergenerational spaces in large scale urban environments differ depending on culture and local, regional, and national government, making them challenging to implement and evaluate (Melville, 2013). The growth and integration of these types of spaces will allow environments to be designed so that all facets of the population can access these spaces (Van Vliet, 2011). Kaplan identifies key design characteristics of intergenerational spaces. He emphasizes designing flexible environments while actively considering the context of the design: the context then informs how the space should be maintained and managed. Similar to the goals of collaboration spaces in a work environment, Kaplan claims that the function of these spaces should be to empower people and provide opportunities for unplanned interactions (Kaplan, 2007).

#### 2.4 Theoretical Perspective

This research will begin to fill the gap in knowledge between generation and collaborative spaces by applying Becker's 2007 theory of organizational ecology, published in, "Organizational Ecology and Knowledge Networks" to evaluate a collaboration space from a holistic perspective. Becker's proposed organizational ecology principles grow from the idea that it takes an alignment of a full system to harmonize a workforce made up of knowledge workers (Becker, 2007). Using this perspective, this research will account for individual employee differences, as well as the greater context that the collaboration space is in. This includes where the

collaboration space is located in relation to other buildings, and how employees perceive the space related to their primary workstations and the overall Boeing facilities. Lastly, the organizational context will be considered in terms of the social, economic, political, factors that have internally and externally shaped the company, as well as company competitors, core corporate values, organizational culture, and the existing space typologies within the company.

### 3. RESEARCH STATEMENT

This research examines whom collaboration spaces in the workplace are actually supporting, during the time of generational transition in the workforce. The objective of the research is to understand how generation links to space use and perceptions of a collaborative space in the work environment. Two hypotheses will be tested:

H1. Millennials use the ECDC more than Generation Xers and baby boomers.

H2. Millennials have a more positive perception of the ECDC than Generation Xers and baby boomers.

Additionally variables relating to an employee's primary workspace and the workplace as a whole will be examined in order to understand this relationship in terms of the greater organizational ecology.



#### 4. INTRODUCTION OF COMPANY AND SITE

The Boeing Company is a massive corporation with 148,000 employees in more than 65 countries on six continents (not including suppliers or partners). It has customers in more than 150 countries. Bill Boeing founded the company in 1916. Boeing started out making Model C seaplane trainers and has evolved to produce dozens of products and services in three main divisions: Commercial Airplanes; Defense, Space & Security; and Boeing Global Services. The company is consistently ranked a top innovator among aerospace companies and has an expansive product line that includes flight vehicles for commercial and defense use, space and satellite equipment, and underwater vehicles and technology (Boeing, 2017). The history of Boeing reflects a strong emphasis on exploring new avenues of engineering and pushing the limits of technology through design.

The size of the company reflects the complexity and magnitude of factors impacting it. Spaces within The Boeing Company were selected for this study because the company is largely impacted by the generational shift in the workforce. The company went through a hiring boom in the 1960s when it won the contract to build part of the Saturn V rocket and manufacture the 747 airliner while continuing to produce previous successful products (Boeing History, 2017). As a result, much of The Boeing Company is comprised of a generational gap between the “lifers” who have been at the company 20 years or more and the “new hires.” Over the next 10 years, more than 50% of their workforce will be eligible to retire. A company of this size will need to hire approximately 74,000 people in the next decade to backfill for a large subset of employees, including many of the most intelligent, knowledgeable, and

experienced employees in the company. Each summer Boeing takes close to 1,700 interns worldwide helping to attract new talent (Forbes, 2015). Filling this gap with young talent while making a smooth transition between generations is crucial to achieve innovation and to compete against rival companies such as Airbus and SpaceX.

The site is located in Philadelphia, PA. It is part of Boeing's defense sector where a variety of operations take place that are mainly centered on rotorcraft development, production, and support. Some of these operations include the H-47 Chinook, V-22 Osprey, and Future Vertical Lift/Joint-Multi-Role programs, as well as fabrication, services and support, and engineering work for projects across The Boeing Company. There are approximately 4,600 employees working there on a 355-acre site that has manufacturing space and more than 1 million square feet of office space (Boeing Frontiers, 2005). The campus is spread out and divided by a major highway. The highest density of buildings where many of the offices are still require a 5-10 minute walk between buildings, through parking lots and across roads (Figure 4.1).



Figure 4.1: Company Site (Google Maps, 2017)

#### 4.1 Values

Boeing's core principles encompass: diversity and inclusion, health and well-being, safety, ethics, sustainability, and community engagement. There is a clear message of giving back to the community through education, volunteer work, and supporting a strong ethics inside and outside of the company. Internal company values can be seen in a variety of company initiatives. Employees interested in returning to school have the option to take an educational leave of absence (ELOA) where Boeing supports the majority of education fees. Employee career development opportunities can be found in women's groups, recreational groups, rotational programs, and volunteer groups. These highlight and encourage diversity in the workplace by recognizing the strengths of bringing together employees with different perspectives (Boeing, 2017). Boeing emphasizes work-life balance and prioritizing people first. These corporate values impact all employees, and as a result Boeing has been consistently recognized as a top company to work for. Boeing is consistently Vault Top Rated as an organization, and also was rated first in the Forbes Top 10 Best Tech & Engineering Internships for 2016, rated above Google, Apple, and even SpaceX (Adams, 2015; Best, 2017).

#### 4.2 Social Climate

In the recent years there have been growing social concerns relating to the environment, community values, and equality in the workplace. These concerns have placed a social corporate responsibility on big businesses to not harm the environment and give back to the community. Boeing meets these standards by setting company

mandated goals such as increasing fuel efficiency for the 787-10 Dreamliner by 25% over the next five years, funding explorations in solar powered vehicles, and reducing solid waste in the workplace and manufacturing processes (Boeing Environmental Report, 2017). Boeing contributed \$18 Million to nonprofit organizations in 2016 and continually highlights equal opportunities for minorities and women in STEM field with campaigns like “Women Make us Better” (Boeing Engagement, 2017). Additionally, health and safety in the workplace are a priority with initiatives such as “Go for Zero,” a campaign for zero injuries in the workplace (Boeing, 2017).

#### 4.3 Economic Climate

The U.S. economic climate can be characterized by the status in the overall national and global marketplace. In general, according to the Bureau of Economic Analysis the United States GDP has increased by approximately 0.2% due to higher consumer spending, business investment, and exports (U.S. Department of Commerce, 2017). Additionally, stock market prices have increased over time, and the economy has recovered from the 2008 crash, at least for the time being. Boeing stock prices have continued to rise over time and are currently at a high, a reflection on the general financial well-being of the company (Google Finance, 2017).

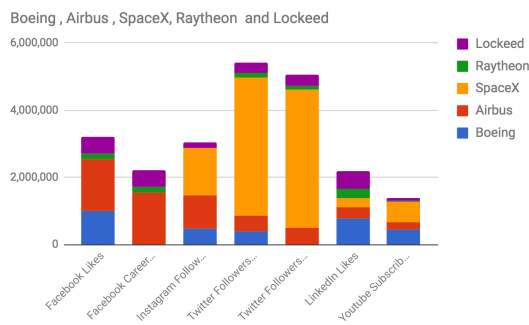
#### 4.4 Political Climate

Politics have an impact on local and global society as a whole, often informing public policy, funding for macro-level projects, and the tone of international relationships. Since the U.S. government is one of Boeing’s main customers, the US political climate often impacts Boeing’s defense contracts. Throughout history Boeing has been able to stabilize some of these fluctuations with the commercial side of its

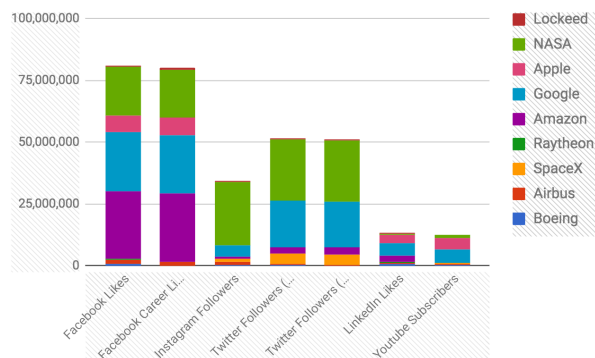
business. Over the last few years government defense spending has increased, but this has not directly translated to increased revenue for Boeing. Despite the increase in defense spending Boeing is facing greater competition now more than ever (Adams, 2015; Gates, 2015).

#### 4.5 Competitors

The rapid advancement of technology has allowed new companies like Airbus and SpaceX to arise and successfully compete with Boeing. This has led Boeing to restructure their human capital within organization and strategically developed methods for attracting and retaining new employees. For example Boeing announced that they were cutting 8,000 jobs on the commercial airline side in 2013 in order to cut costs and successfully compete with a European competitor (Boeing, 2017). Further, as a result of changes in programs and cost of maintaining multiple southern California sites the company is shifting 2,400 jobs from Huntington Beach to other areas (Gates, 2017; Roosevelt, 2016). Competition in the labor market has grown due to the fluidity of top talent between the engineering and technology industries. Competition is changing, where Boeing now needs to be aware of the competitors that can arise from unexpected industries. Successful company leaders like Jeff Bezos and Elon Musk make large investments in other, seemingly unrelated industries, resulting in highly competitive “start-ups”. Similarly the competition scene for attracting and retaining employees has largely shifted to digital communication tactics. Competition for talent is reflected in likes and follows on social media, which portrays individual interest in a company (Figure 4.2).



Traditional Competitors



General Competitors

Figure 4.2: Social Media Competitor Comparison

#### 4.6 Technology

Changes in technology also drive internal changes to the company such as types of communication, use of resources, and methods of design and production. Technological advances over the last one-hundred years have allowed, reiterations in product lines such as the 737, 777 and the 787, faster manufacturing techniques, and improvements to the assembly line processes. In the office environment most tasks can be accomplished with a laptop and cell phone. The capability to work mobile has influenced how global companies like Boeing function allowing them to innovate through all functions of the company (Boeing, 2017).

#### 4.7 Culture

The company culture at each Boeing location differs slightly, likely due to geographic location, product line, and leadership style. Overall Boeing strives to have a “ONE Boeing” corporate culture. This initiative reflects the greater community and shared mission that Boeing employees are a part of. This concept would allow a Boeing employee to go to another Boeing site anywhere in the world and be able to

successfully work for the day by following the same company standards, policies, and procedures regardless of location. The corporate culture is also reflected in the organizational hierarchy. Boeing has a vertical organization structure, stacked with levels of management. There are strict policies about requirements that employees need to have before moving up in the hierarchy. For example, working in a certain position for  $x$  number of years before being promoted. With each job levels comes a clear guideline for perks and allowances. Using space allocation as an example, each job level is tied to primary workstation requirements. Primary workspace size increases as job level increases. Culture has been addressed as a challenge repeatedly for Boeing, balancing the extremes of the generational ideals. In 2017 Puget Sound Professors wrote a book, “Emerging From Turbulence” telling the stories of Boeing employees and the highlighting the challenge the company faces with evolving company culture (Gates, 2015).

#### 4.8 Collaboration Spaces

With a company that has some of the largest facilities in the world, Boeing has workspaces with a range of designs and purposes. Boeing has adopted industry design trends throughout their facilities, which include a range of collaborative space typologies. Collaborative spaces have also been designed for specific projects and uses, made for a narrower subset of The Boeing population. For example, design review spaces are made for teams to meet and discussion a project they are working on sometimes for hours on end. These spaces include plenty of available pin-up space and enough room for larger groups teams to meet and discuss. Similarly, innovation cells are designed for larger collaborative projects, usually equipped with comfortable

furniture and flexible seating arrangements. Immersive development spaces are similar to these in the nature of specialization and a narrow population of regular users except they are equipped with the top collaborative technology. Additionally, restoration rooms are designed for employees to take a break from technology and converse with each other in a comfortable environment. Boeing has implemented open office layouts, which are designed to encourage greater communication and collaboration among groups. One of the more successful examples within the company is at the Boeing 737 manufacturing site in Renton, Washington, designed by Steelcase. The renovation of this office space found that creating an open plan and strategically placing manufacturing teams near engineers helped problem solving occur faster, lead time to decrease, and there was an increase in the employee's sense of connectivity (Boeing Redesign, 2015). In contrast, Boeing has also implemented collaborative space typologies that are intended for the general work population. On a small scale, huddle rooms have been implemented throughout a variety of office locations. These comfortably accommodate 2-4 people and are often not fully equipped with conference room technology but instead designed for brief impromptu private conversations. Engineering Career Development Centers are designed with the intent of providing a space for engineers to collaborate that any employee can use.



## 5. METHODOLOGY

This is a case study approach evaluating the space use and employee perception of the ECDC in Boeing Philadelphia using behavioral observation measures and qualitative and quantitative self report measures. Measures of how the space was actually used were documented to account for impromptu usage of the space.

### 5.1 Research Setting

The setting under analysis for this research is one of the Engineering Career Development Centers (ECDC) at The Boeing Company. This space is designed for engineers to have a place to collaborate, share ideas and help individuals reach their career goals. The Philadelphia ECDC is located central to a few of the main departments of engineers, further from employees working in manufacturing. Prior to entering the room there is clear visual prospect. The entirety of the room is seen through three glass walls enclosing the space one being a floor to ceiling wall with a view outside, and access to natural light. There is a security camera mounted in the room with a note that the room is being monitored. This room is set-up with a large table with stools surrounding it. Within the shelves under the table there are screws, nuts, bolts, and other hand tools that would be used for constructing prototypes. Outside of the space across the hall lives the 3D print lab. The space is also equipped with a large monitor mounted above the table with tools, a foosball table, movable whiteboards, whiteboard walls, bean bag chairs, and three breakout spaces, each with a white table and chairs, seating 2-3 people comfortably (Figure 5.1).

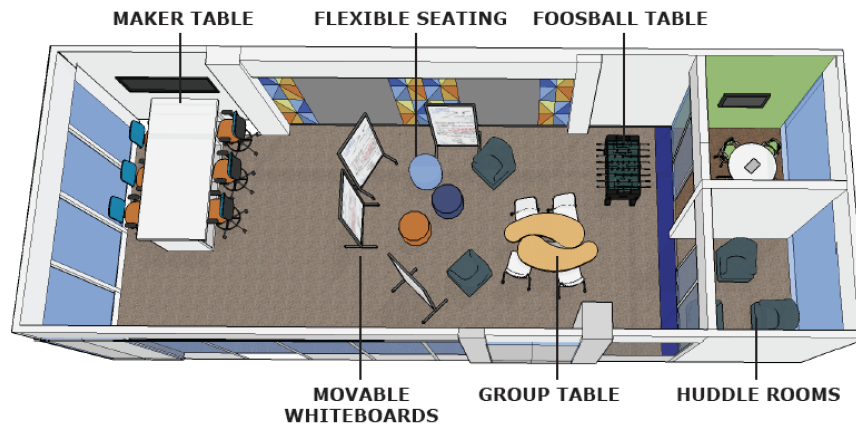


Figure 5.1: Diagram of the ECDC

The space was remodeled and finished in the spring of 2016. It was designed with the intent for impromptu meetings rather than relying on the room reservation system. Since this collaborative space was newly built it has received mixed reviews in terms of how employees perceive the space and how well the space is actually functioning. Evaluating this space will provide insight for designing future spaces to meet the needs of employees and inform company practices and iterations that can be done to the current space to maximize the spaces full capability.

Both quantitative and qualitative research methods were used to evaluate this space. These included observations, an online survey, and interviews with key stakeholders.

## 5.2 Observations

Observations were made once per hour for five different days of the week, Monday through Friday, over the course of three weeks. Observers noted the number of people in the space, the primary activities happening, the location where people

were working, and the resources that employees utilize in the space. Primary activities in the space were categorized by either: informal meeting, status meeting, lunch meeting, extracurricular group meeting, or foosball playing. Additionally, a comments section was provided to add notes for unusual or notable activity. Interaction logs were coded based on the frequency that a location was used and the type of activity happening at each location.

### 5.3 Survey

A 25-question survey was developed to understand the employee population in terms of general demographics, nature of work, employee satisfaction with their primary workspace and the ECDC, and an the overall employee perception of the site facilities. Questions related to the ECDC were both open ended and collected using a Likert scales ranging from 1-7, 1 being strongly agree, 7 being strongly disagree. The survey was distributed one year after the completion and occupancy of the ECDC via email to all engineers working at the Boeing Philadelphia site to invite voluntary participation. An email was sent with the survey link twice, one month apart from each other. Participants identified with a generational range defined in the survey as a millennial (born 1980s-1990s), Generation X (born 1960s-1970s), or baby boomer. Other variables were tested to understand general employee use and perception of the ECDC, primary workspaces, and overall facility. Additionally potential confounding variables as identified in previous literature were tested.

Survey data was analyzed through linear models of associations and relationships. Open-ended survey questions were coded through frequency of word use or topic referenced. Methods of analysis included using linear models such as

independent T-Tests, ANOVA, and linear regression. Additionally a factor analysis was used to measure overall satisfaction with the collaborative space. Significant relationships were considered with a  $p$ -value  $< 0.05$ .

#### 5.4 Interviews

Interviews were conducted to clarify qualitative responses and gain a better understanding of the organizational culture and space use. All interviewees were asked questions about their relationship to the physical environment and experience using collaborative spaces throughout company facilities. Interviewees were recruited through a snowball sampling technique that began with employees supporting workplace design improvements as well as employees who preferred maintaining the status quo of their work setting. Interviewees consisted of employees of different generations, including two exit interviews with “new hire” employees. The exit interviews were with employees who planned to leave the company because of opportunities at competing companies after working at Boeing for a few years. These employees were asked to reflect upon their Boeing career, identify the key factors in leaving and identify critical changes Boeing would have to make for them to remain at the company. Both the interviews and qualitative survey responses were coded based on keywords used and topics mentioned throughout the transcripts.

## 6. FINDINGS

Data was collected through interaction logs, both open-ended and closed-ended survey questions, and interviews. Survey data was collected from employees on their perception of the ECDC, their primary workspace, and the facilities in general. Of the responses, one building location was excluded due to low response rate within that category, leaving three buildings that primarily house engineers and an, “other” category that includes a variety of other facilities throughout the 355-acre site used for testing, manufacturing, and other functions. Additionally respondents who left more than 30% of the questions blank, were eliminated from the sample. A total of 283 employee responses were included. Counts for variables of interest were broken down by generation, primary work location, and building assignment (Table 6.1). Primary work setting included five categories. The “other” within the primary work setting category accommodated for the small population of hoteling or remote workers.

Generation	
Level	Count
Baby Boomers	75
Generation Xers	102
Millennials	106
Total	283

Building Location	
Level	Count
Building A	30
Building B	79
Building C	16
Other	158
Total	283

Primary Work Setting	
Level	Count
Individual Cubicle	215
Other	5
Private Office	25
Shared Cubicle	34
Shared Office	4
Total	283

Table 6.1: Overall Sample

## 6.1 Typical Workday Summary

A typical workday can be described in terms of the nature of work and location where that work takes place. On a regular day employees at this site primarily spend their time working by themselves on a computer, this excludes conference calls or video conferences. When they are not working independently employees are having unscheduled face-to-face collaboration or scheduled face-to-face meetings, mostly at their own workspace or someone else's workspace; if they were unable to meet at a workstation, they would be in a conference or meeting room. Of the respondents that use the ECDC, 37% of them hold their meetings there.

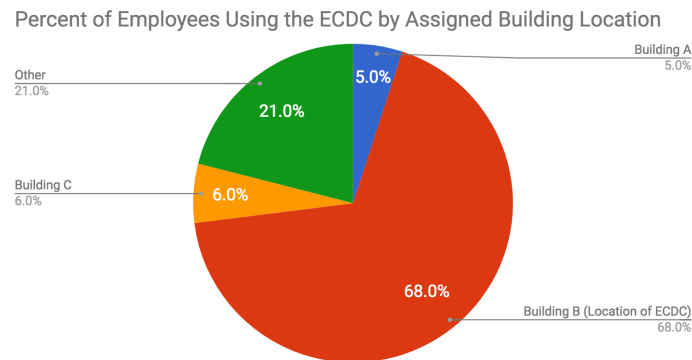


Figure 6.1: Percent of Employees Using the ECDC by Assigned Building Location

An average day for the ECDC can be described with the space occupancy levels, locations within the space that are used, the activities that are happening at those locations, and the resources employees are using for those activities. On an average day the ECDC is occupied 78% of the 8:00am-6:00pm work day. The center

table, table A, is used the most while the whiteboard location, location B, is used the least (Figure 6.2).

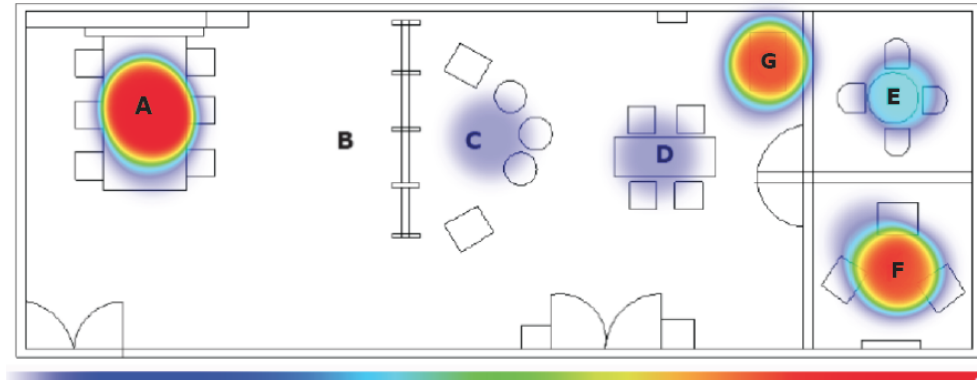


Figure 6.2: Heat Map of Location Usage on Floor Plan

The space is used at peak points that mirror how employees structure their days. The mornings are busy with status meetings. During this time the average occupancy of people in the ECDC at one time is 4, the range being 0-6 people at once. As the day continues, informal meetings, foosball playing, and lunch meetings take place in the space (Figure 6.3). To accommodate these activities, laptops are used the most (40% of the time), then the large monitor at the central table (25% of the time), followed by: notebooks (20%), cell phones (10%), and whiteboards (5%). After lunch there is a quiet period, the huddle rooms are occupied on and off but sometimes the space is completely empty. At the end of the day, around 5:00 pm, small groups of employees meet in the space for a weekly internal extracurricular group meeting.

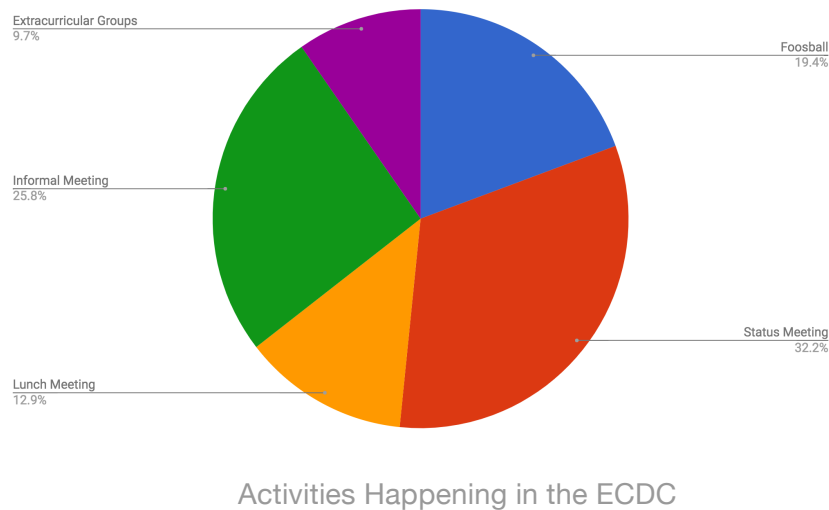


Figure 6.3: Activities Happening in the ECDC

## 6.2 Generation and Collaboration Space Use

Two hypotheses were tested to understand how employees of different generations use and perceive the collaboration space. The first hypothesis tested was: Millennials use the ECDC more than Generation X'ers and baby boomers.

Results show there is a significant difference between generation and space use ( $p = 0.001^*$ ). Millennials use the ECDC more than other two generations. Responses to the question, “have you ever used the collaboration space in building B?” showed that millennials have used the space the most, followed by Generation Xers, and baby boomers (Figure 6.4). Additionally, millennials hold more meetings in the collaboration space than other generations. Of the employees that use the collaboration space for meetings, there is a significant association between generation and space use for meetings ( $p = 0.001$ ).



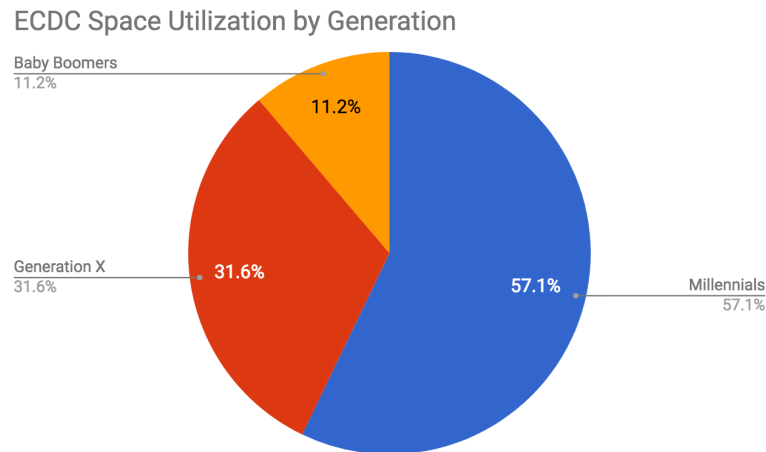


Figure 6.4: ECDC Utilization by Generation

Within the sample of employees who use the space, foosball players are almost all males below the age of 30 and groups with younger leads and managers (ages 30-35) tend to use the center table and the huddle room, greater compared to more seasoned employees. There is no age bias for the usage of the center locations and back huddle room (Figure 6.5).

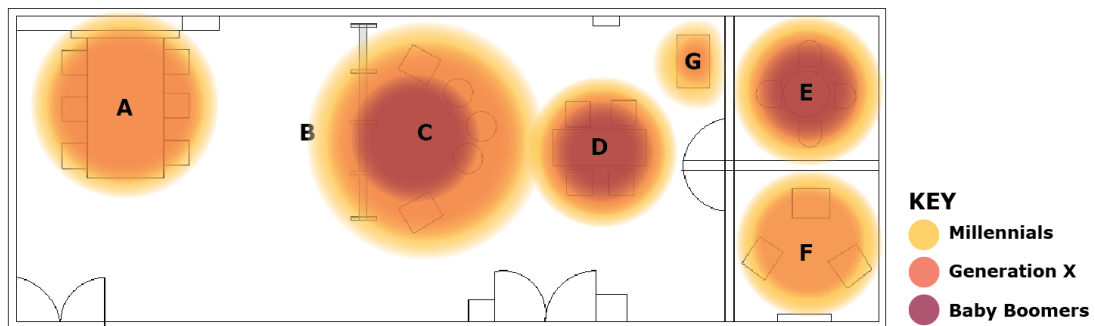


Figure 6.5: Location of Space Used by Generation

When controlling for assigned building location and testing generational differences with space use, there was still a significant relationship between generation ( $p=0.0002^*$ ) and building location ( $p < 0.0001^*$ ). Looking further at the odds ratios for

each generation, findings show significant differences between millennials and baby boomers ( $p=0.0003^*$ ). Millennials are 6.6 times more likely to use the space than baby boomers. There is also a significant difference between millennials and Generation Xers ( $p=0.0090^*$ ). Millennials are 2.9 times more likely to use the space than Generation X employees. There is no statistically significant difference between Generation Xers and baby boomers in terms of collaborative space use (Table 6.2).

Odds Ratios for Generation					
Level1	/Level2	Odds Ratio	Prob>Chisq	Lower 95%	Upper 95%
Generation X	Baby Boomer	2.2804615	0.1292	0.7861132	6.6154651
Millenials (Born 1980s -1990s)	Baby Boomer	6.6336577	0.0003*	2.370284	18.565461
Millenials (Born 1980s -1990s)	Generation X	2.9089102	0.0090*	1.3058457	6.4799068
Baby Boomer	Generation X	0.4385077	0.1292	0.151161	1.2720814
Baby Boomer	Millenials (Born 1980s -1990s)	0.1507464	0.0003*	0.0538635	0.4218904
Generation X	Millenials (Born 1980s -1990s)	0.3437714	0.0090*	0.1543232	0.7657873

Table 6.2: Odds Ratios for Generation

Results testing the relationship between assigned building location and ECDC use are statistically significant ( $p<0.0001^*$ ). In all cases employees located in building B, the same building the ECDC is located, are significantly more likely to use the space. There is a significant difference between building B and building A ( $p < 0.0001^*$ ). Employees in building B are 65 times more likely to use the building than building A. There is also a statistically significant difference between space use and employees in building B to building C ( $p < 0.0001^*$ ). Employees in building B are 20 times more likely to use the collaborative space than employees in building C. Lastly, there is a significant difference in between employees in building B to employees in “Other” buildings ( $<0.0001^*$ ). Employees in building B are 67 times more likely to use the ECDC than buildings in “Other” buildings (Table 6.3).

### ▼ Odds Ratios for Building Location

Level1	/Level2	Odds Ratio	Prob>Chisq	Lower 95%	Upper 95%
Building B	Building A	65.26715	<.0001*	17.300322	246.22668
Building C	Building A	3.195576	0.1202	0.7383071	13.831244
Building C	Building B	0.0489615	<.0001*	0.0122482	0.19572
Other	Building A	0.9726419	0.9605	0.3248047	2.9126187
Other	Building B	0.0149025	<.0001*	0.0055493	0.0400203
Other	Building C	0.3043714	0.0471*	0.0940693	0.9848267
Building A	Building B	0.0153216	<.0001*	0.0040613	0.0578024
Building A	Building C	0.3129326	0.1202	0.0723001	1.3544499
Building B	Building C	20.424221	<.0001*	5.1093394	81.644369
Building A	Other	1.0281276	0.9605	0.3433337	3.0787728
Building B	Other	67.102957	<.0001*	24.987289	180.20389
Building C	Other	3.2854599	0.0471*	1.0154071	10.630462

Table 6.3: Odds Ratios for Building Locations

Based on the survey responses, 28% of the employees are assigned to building B, where the ECDC is. On average, employees assigned to building B use the ECDC 68% of the time (Figure 6.1). A majority of the employees who do use the space (76%) are located in the same building as the ECDC and use the space because it is most convenient for them compared to employees in other buildings (building A 3%, building C 5%, other 17%). However, regardless of what building an employee is assigned, their overall perception of the ECDC is not statistically significant different.

There is also an association between primary workspace and building location ( $p = 0.0033^*$ ). Employees with private offices are more likely to be located in “Other” buildings. Some of the buildings do not employee responses from all primary work-setting types, or the building does not have the full range of primary work setting types. For example, building C did not have any respondents in private offices or shared cubicles, while building A did not have any employee responses in shared offices.

Similarly, the range of responses of employees in each generation located in each building location is not evenly distributed. Building B and building C have the

most millennial and least baby boomer respondents, while building A has the most Generation X respondents and least baby boomer respondents, and “Other” buildings have the most Generation X respondents and least millennial respondents (Table 6.4).

Generation	Building Location			
	Building A	Building B	Building C	Other
Baby Boomer	5	10	4	55
Generation X	14	26	5	57
Millennials	11	42	7	46

Table 6.4: Generation by Building Location

### 6.3 Generation and Perception of Space

The second hypothesis tested was: Millennials have a more positive perception of the ECDC than Generation Xers and baby boomers. Generational differences in employee perception of the collaboration space were tested using a survey and employee interviews. Statistical tests controlled for primary work setting, building location, and personality, and still showed significant relationship between generation and overall perception of the collaboration space ( $p=0.0348^*$ )(Table 6.5).

Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Primary Work Setting	3	3	1.2389410	0.4578	0.7125
Building Location	3	3	2.1862608	0.8079	0.4929
Generation	2	2	6.3013192	3.4927	0.0348*
Introvert/Extrovert	1	1	0.5170225	0.5731	0.4511

Table 6.5: Effect Tests Controlling for Other Variables

Results show there is a statistically significant differences in the perception of the space for baby boomers ( $p=0.0105^*$ ) and Generation Xers ( $p=0.0416^*$ ). After running a Least Square Means Differences Tukey test, the difference in perception of

the ECDC is significant between baby boomers and Generation Xers ( $p=0.0207^*$ ). Generation Xers have a more positive perception than baby boomers. The perception of the space was also significant between baby boomers and millennials ( $p=0.0284^*$ ). Millennials have a more positive perception of the space than baby boomers. There are no statistically significant differences between the preferences of millennials and Generation Xers.

The survey tested the following individual variables relating to the collaboration space: availability of the space, layout, supporting technology and resources, level of privacy, suitability, control, as well as overall perception of the ECDC (Table 6.6). There is an association between generation and overall perception of the ECDC. Millennials have a stronger positive perception ( $M=2.8$ ) while baby boomers had a neutral overall perception ( $M=3.8$ ). The only other statistically significant difference between generation and the perception of space is the sense of control over the ECDC ( $p = 0.0162^*$ ). Baby boomers felt less control over the ECDC compared to millennials. All other variables, aside from the overall perception, showed some differences however, are not considered statistically significant.

	Generation					
	Baby Boomer		Generation X		Millenials	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
ECDC: I can always find a place to have a meeting when I need it, whether reserved in advance or not.	3.45	1.24	3.36	1.52	3.28	1.34
ECDC: Furnishing Support Meeting Effectiveness	3.34	1.21	3.46	1.39	3.09	1.42
ECDC: Technology (e.g. whiteboards) Support Meeting Effectiveness.	3.20	1.25	3.19	1.34	2.97	1.46
ECDC: The meeting spaces provide sufficient privacy if needed.	3.57	1.33	3.87	1.38	3.90	1.46
ECDC: There are suitable places for collaborative work, meetings or conversations necessary for my work.	3.32	1.20	3.24	1.31	3.04	1.47
ECDC: I have Control over the setting which meet my needs	4.02	1.01	3.61	1.21	3.43	1.37
ECDC: Overall Perception	3.64	0.90	2.76	0.79	2.83	1.00

Table 6.6: Variables in the ECDC and Overall Perception

The responses from the open-ended survey question showed the same results, while providing insight into individual perceptions within each generation. Overall,

millennial employees felt positively towards the addition of the ECDC. Employees in this generation commented explicitly about the design and use as well as the symbolic value of the space. Employees mention there is a need for more spaces like these,

“I don't even know which building the collaboration space is in, but there is a massive need for that type of space over in my building. All of the conference rooms are dominated by individual subprograms and it's extremely difficult to have a meeting, let alone an informal space to collaborate.”

Some millennials feel that the facility should be accountable for inspiring employees. This could be through design choices such as adopting brighter colors, allowing natural light in the building, and utilizing engaging wall art, or making the facility a greater symbol of progression,

“...Continued proliferation of other technologies with these rooms would could also be useful...these are not only useful tools, but help connect people to the product as well as reinforce that we work for a cutting edge technology company, which at least to me is incredibly motivating.”

Despite this desire for innovation, the organizational culture can be seen as a barrier;

“*[What improvements or changes would you like to see in the facility?]*  
Communication with leaders with regard to the value of a collaborative space. I've heard several managers speak negatively of the space referring to it as "the lounge" and threaten what they would do if they caught their people "goofing around" over there.”

Yet, this cultural view may not be tied to a generation, “[Facilities should] focus more on workspace rather than play space- more room in the collaboration area is taken up

by foosball tables than actual work space.” None of the millennials mentioned removing the space, however there were recommendations for changing the layout, or moving the foosball table to another location to reduce noise.

In contrast, baby boomers generally feel neutral about the ECDC aside from a few extremist views against it. A small portion of baby boomers (2.5%) requested to remove the collaboration space. This 2.5% believe that, “no one uses this space,” and “there is no use for it.” Some concern for the implementation process of the ECDC was raised. When the ECDC was first introduced an individual employee felt discouraged to use the space because they were not part of a specific team and since then has not used it. However, the majority acknowledges this gap in understanding of the purpose of the space without discounting the space; “Not sure what the collaboration rooms are but we need more conference rooms in general.” Most baby boomers instead suggest improvements relating to visual or acoustic discomforts in the general workplace. For example, using glass lowers privacy in the space or providing an open layout results in lower acoustic control. A small portion of baby boomers want to see more collaboration spaces, with layout, visual, and acoustic improvements.

Generation X employees overall feel positively about the ECDC, however, they do have mix of opinions similar to the perceptions of both the millennials and baby boomers. On one hand, some point to the same underlying concerns that millennials bring up with organizational culture and leadership opinions,

“The perception of the collaborative work space is that if you are in there, you are not on the clock. It's playtime not work time. Until the baby boomers retire, or management practices change, this room takes up valuable real estate.

Management uses the space to identify the next people to receive a layoff notice.”

There were also responses pointing to the symbolic quality of the space, similar to individuals in the millennials generation;

“Being assigned to building C, it would require a 10 minute walk each way. So if I have 1hr available, 33% of that time goes to walking to and from the collaboration space. It is therefore suggested to not request such a large investment for something you wish to be utilized. Could you find an extra 20 minutes in your week to walk to another room? With the workload and staffing constraints, walking to this space is not the big rock - it's the air that was displaced.”

On the other hand, employees of this generation recommended removing the space, similar to baby boomers. Employees of this generation say they do not use the space rather than saying negative comments about it. The few individuals in this generation that perceive the space negatively (3.8%) make comments such as, “Collaboration space in building B is useless. Goes empty the majority of the time. Wasted company money and resources.”

Lastly, a key aspect unique to Generation Xers is the enthusiasm towards the huddle rooms within the collaboration space. Most comment on the benefit of having small informal spaces to meet while addressing the benefit of the collaboration space as whole, even if they are not users of the space; “I don't use it that frequently as I have a private office, but it is useful. I would think perhaps it would be useful to have a way to partition the space in case multiple discussions are going on.”



#### 6.4 Organizational Ecology

To understand how this space fits into the larger organizational ecology, employees were also asked about their primary assigned workstation and perception of the overall facility.

*Primary Workspace.* The survey asked questions about an employee's primary assigned workstation. The primary workstation categories included: private office, shared office, private cubicle, shared cubicle, or other (Table 6.7).

Primary Work Setting	Generation		
	Baby Boomer	Generation X	Millenials
Individual Cubical	51	73	90
Other	0	2	1
Private Office	7	14	4
Shared Cubical	14	10	10
Shared Office	1	2	1

Table 6.7: Counts of Primary Workspace by Generation

Associations were tested between generation and primary workstation. Although employee office space allocation is tied strictly to job hierarchy, there is no statistically evident association between the type of primary space that an employee has and generation. However there are generational differences in the overall perception of the primary space. Results show that baby boomers have a more positive perception of their primary space than Generation Xers, followed by millennials (Table 6.8). In contrast, millennials feel their primary workstation meets solo needs greater than Generation Xers and baby boomers ( $p=0.001$ ).

<b>Means and Std Deviations</b>						
<b>Level</b>	<b>Number</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Std Err Mean</b>	<b>Lower 95%</b>	<b>Upper 95%</b>
Baby Boomer	73	3.74658	1.65648	0.19388	3.3601	4.1331
Generation X	100	3.46000	1.57262	0.15726	3.1480	3.7720
Millenials (Born 1980s -1990s)	104	2.91827	1.31848	0.12929	2.6619	3.1747

Table 6.8: Perception of the Primary Workspace by Generation

A further analysis reveals that individual differences are evident when measuring an employee's sense of control in the workspace. Employees in private offices reported feeling the most control over their workspace compared to employees assigned to other settings ( $p=0.0001^*$ ) yet there was little difference in terms of these employees sense of control over the ECDC (Table 6.9). Despite these differences there is no statistically significant relationship between employees assigned to cubicles compared to those in private offices and the use of the ECDC. However, employees in individual cubicles perceive the ECDC more positively than other groups.

<b>Means and Std Deviations</b>						
<b>Level</b>	<b>Number</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Std Err Mean</b>	<b>Lower 95%</b>	<b>Upper 95%</b>
Individual Cubical	211	3.93365	1.71141	0.11782	3.7014	4.1659
Other	3	4.00000	0.00000	0.00000	4.0000	4.0000
Private Office	25	2.40000	1.87083	0.37417	1.6278	3.1722
Shared Cubical	34	4.88235	1.78826	0.30668	4.2584	5.5063
Shared Office	4	2.75000	1.50000	0.75000	0.3632	5.1368

Table 6.9: Sense of Control Over Primary Workspace

Lastly there is a significant relationship between employee's primary workspace and overall perception of the building. Employees with private offices felt that overall the facility meets their needs better than other groups followed by

employees in shared offices, other, private cubicles, and shared cubicles ( $p=0.0023^*$ ) (Table 6.10).

<b>Means and Std Deviations</b>						
<b>Level</b>	<b>Number</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Std Err</b>	<b>Lower 95%</b>	<b>Upper 95%</b>
Individual Cubical	197	3.29442	1.52350	0.1085	3.080	3.5085
Other	3	3.00000	1.73205	1.0000	-1.303	7.3027
Private Office	24	2.16667	1.00722	0.2056	1.741	2.5920
Shared Cubical	28	3.67857	1.56474	0.2957	3.072	4.2853
Shared Office	4	2.25000	0.50000	0.2500	1.454	3.0456

Table 6.10: Primary Workspace and Overall Perception of the Building

*General Facility Perception and Generation.* Employees were also asked an open-ended question to identify the best facility improvement. Results show there were generational differences in overall preference. Millennials identified the addition of the ECDC to be the most positive facility improvement. Generation Xers followed closely with this opinion, where in contrast baby boomers felt improvements to furniture and finishings and ambient conditions were the most notable. Furniture and finishings as a category includes: improved cubicles (preferences for both higher/lower and bigger/smaller) desk furniture such as new chairs, or the option for standing desks, as well as new paint jobs, repaired materials, or updated finishings. Ambient conditions as a category includes: access to daylight, improved artificial lighting, thermal control, and noise reduction and acoustic control. Millennials brought up improvements that baby boomers did not, such as mothers' rooms and private meeting rooms. In contrast, baby boomers brought up the cafeteria and parking as positive areas of improvement, which millennials did not mention. Generation Xers fell in between both of these generations with their responses. They found the addition

of the collaboration space to be a positive change, like millennials, but they also had the highest preference for the huddle rooms within the ECDC (Figure 6.6).

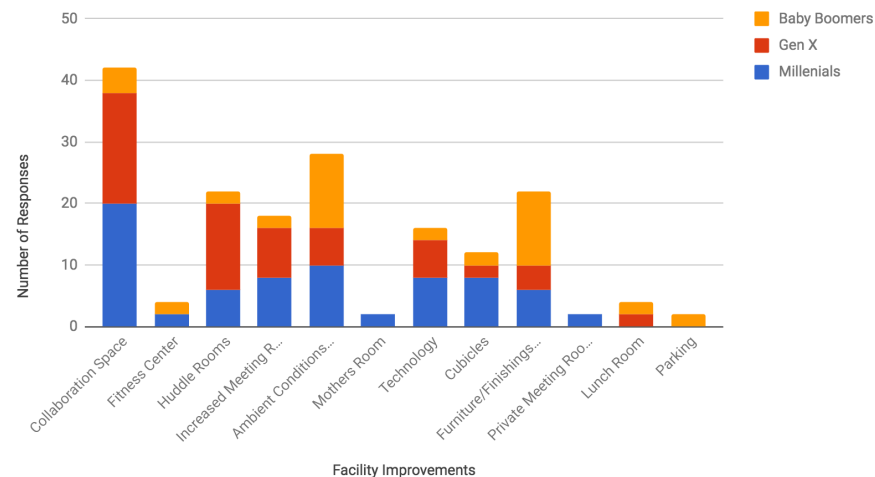


Figure 6.6: Most Favorable or Effective Facility Improvement by Generation

Employees were also asked what facility improvements they would like to see in the future. The highest millennial response was an increased amount of collaboration spaces or moving the location of the current collaboration space to be more accessible to employees in other buildings. Furniture and finishings was a close second to this, which included interior design improvements such as: changing the cubicles (preferences for both higher/lower and bigger/smaller), improving desk furniture such as new chairs or the option for standing desks, as well as repairing materials, or updating finishings. Generation Xers and baby boomers both responded with furniture and finishings as their top suggestion for improvements. Millennials brought up topics such as increasing the number of nursing rooms, and improving elevator access, while other generations did not. In contrast, Generation Xers were the

only generation to suggest increased huddle rooms and baby boomers were the only generation to suggest removing the collaboration space (Figure 6.7).

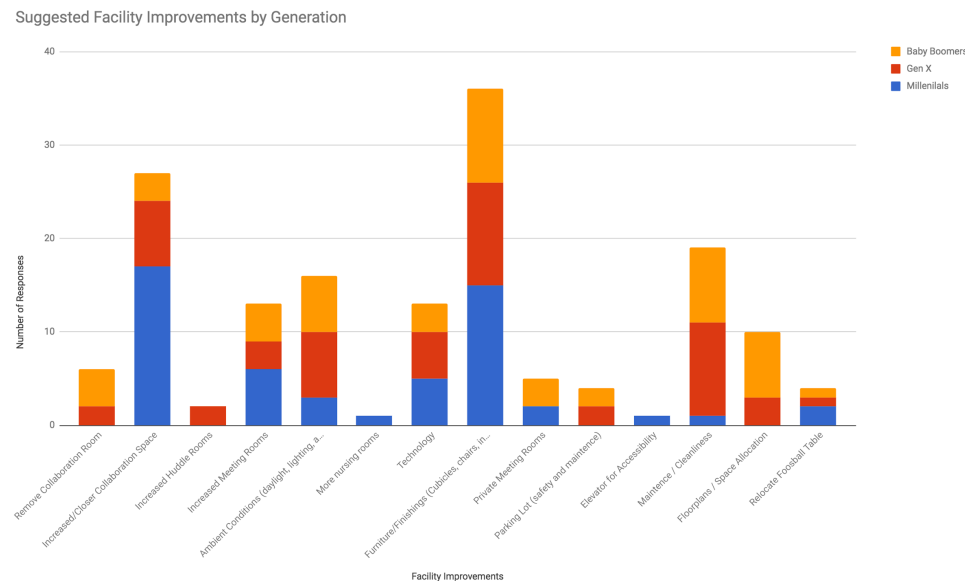


Figure 6.7: Suggested Facility Improvements by Generation

*General Facility.* Additionally, the survey and interviews asked employees how well their facilities are meeting their needs and how accessible the Boeing facilities are for people with a range of abilities. Results show that there is no significant relationship between generation and overall perception of how the workplace is meeting employee needs. However, baby boomers felt that the overall workspace does not support a range of accessibility needs, compared to Generation Xers, and millennials ( $p=0.0024^*$ )(Table 6.11).

<b>Means and Std Deviations</b>						
<b>Level</b>	<b>Number</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Std Err Mean</b>	<b>Lower 95%</b>	<b>Upper 95%</b>
Baby Boomer	67	4.76119	1.49838	0.18306	4.3957	5.1267
Generation X	79	4.03797	1.59682	0.17966	3.6803	4.3956
Millenials (Born 1980s -1990s)	102	3.93137	1.59367	0.15780	3.6183	4.2444

Table 6.11: Generation and Accessibility of the Overall Facilities

When employees were asked about their perception of the physical environment in general, generation did not have an impact on the response or perception. Overall, employees had spent little time thinking about their work environment and off-hand felt a low connection to their workplace. In specific instances, employees described working in multiple settings, such as on the manufacturing floor, in a lab, in an office space, etc. These employees said there was a difference in the underlying feeling behind each of these spaces. Workspaces where the employee worked near the product were spaces where they felt more connected to that place and greater ownership of their work. For example, respondents said, “there is a much more satisfying feeling working next to a product that is larger than you, that you helped build. It’s just not the same to see it on a poster in an office space.”

When employees were asked about the work setting and overall perception of the company responses showed generational differences. Generation Xers and baby boomers felt that the workplace does not factor into their perception of the company. However one respondent shared an anecdote about a client who decided not to sign a contract after visiting the facility, leaving with a resonating explanatory phrase, “the company is a dinosaur.” Employees said that the facility is less of an issue within the company; there is a larger focus on culture change with the generational shift.

In contrast, millennials felt that the work environment was much different from their original expectations. A millennial respondent said that, “for such an innovative company, I was surprised to be put in a cube farm.” Some millennial respondents did not have any input on the workplace and said that it did not make a difference to them what their office space looked like. Other millennials acknowledged that the facility is an important part of daily life whether it is for providing specific resources, or helping to start a larger cultural movement. Some of the interviewees shared a perspective on using the workplace as a bottom-up approach to creating larger company changes. Starting to change the way employees work together and communicate within the workspace will be a step towards an essential culture change.

## 7. DISCUSSION

The purpose of this study was to determine how employees of different generations use and perceive a collaborative space in their work environment and to explain how this relationship exists within the larger organizational ecology. These findings support that collaboration spaces and new space typologies should continue to be implemented, while the design and change process should be strategically planned.

### 7.1 Generation and Space Utilization

Results support the first hypothesis; millennials use the ECDC more than Generation Xers and baby boomers. When controlling for building location, primary workspace, and personality, generation and building location were statistically significant. The ECDC is being used a majority of the time during work hours, despite opinions from a small group of employees who have their doubts. A majority of employees reported on the survey using the space because it is conveniently located. Additionally, a majority of the employees in the space are also assigned to the same building for their primary workspace.

In terms of generational differences, the design and intention of the space is catered toward millennials by providing flexible seating and writable surfaces to match their prior expectations of what a collaborative workspace looks like. Therefore it is not surprising that they are the primary users and the most likely to hold meetings in the space. One explanation for this could be that the appearance of the space meets their expectations of what a workplace should look like before beginning their professional careers. This space typology aligns with the expectations and values of the millennial generation. They expect to work in groups, and have a lower need to



feel ownership over their workspace. It may also be the case that millennials are earlier in their career and are developing new work habits, while baby boomers have a regimented work routine that they have developed over the years, which may be harder to break away from. Additionally the comfort with technology may play a role. Millennials may feel more comfortable with using their mobile technology and adapting to a mobile way of working which, older generations may need more time to adapt to.

## 7.2 Generation and Perception

There is a generational difference in overall perception of the ECDC. Millennials perceive the space the most positively followed by Generation Xers and baby boomers, supporting the second hypothesis. Results on employee perception can be explained through differences in the perception of control, communication about the ECDC, and how company culture is reflected in the physical work environment.

*Control.* The main difference in this perception stems from the level of control over the setting meeting work needs. Baby boomers felt the level of control did not meet work needs well. This could be due to a few factors including the way that each generation uses the space, the symbolic meaning of control, and the link between control and satisfaction.

Of the baby boomers that do use the collaboration space, they are using the space the same way they would use a conference room. In this sense the space provides very little control and does not meet the needs of this generational well. For example, if a team was hosting a weekly private meeting in the collaboration space and another employee decided to come into the space and start playing foosball it

would be incredibly distracting to the employees in the meeting, providing little control over the surroundings of the space.

The importance of control over an environment is an important aspect that is tied to generation and symbolic ownership over space. Historically baby boomers have a higher affinity and expectation for their own spaces in the office compared to other generations. This control over their physical environment may be linked to the progression of career success and entitlement as individuals move up the organizational hierarchy. This symbolic meaning does not translate into shared spaces, perhaps supporting why the lack of control creates a negative perception for baby boomers. The distinction between an employee's primary space and secondary space may be contributing to these differences in perceptions between generations as well. For example, baby boomers have a higher affinity towards their primary space and also request more visual and acoustic control over these spaces. Requests range from, higher cubical halls, increased partitions, frosted covering on glass rooms for privacy, as well as acoustic barriers. There is clearly a need for baby boomers to have control over their primary environment yet the unpredictability of visual and acoustic levels in the space may be undesirable. Baby boomers often use the collaboration space as they would a meeting room, which compared to a bookable meeting room does not accommodate employee needs as well. For example, if a team were to hold a meeting in the collaborative space a small group of football players or another group might join them in the same room. The way that baby boomers are using the collaboration space, it makes more sense to use conference rooms to support their needs. This concept directly links to workplace satisfaction in terms of how well the

environment is able to support employee needs and how their daily routine at work goes.

Additionally it is worth mentioning that control is linked closely to satisfaction over other aspects of an employee's job. A lack of control over an employee's surroundings can cause disruption. For example, if an employee is working in a space where there is constant noise that they find distracting, it may begin to influence how well they are completing their tasks and how they feel about the work environment in general.

*Communication.* Communication about the ECDC also plays a role in how employees understand what the space is and how they interpret it differently. The branding of the space, formal and informal communication from employees, and the design of the space all contribute to the generational differences of perception found.

The space is called, the “Engineering Career Development Center” and includes signage throughout the hallways leading up to the space with a logo and painted name for this space. An employee late in their career may see this space and think that it is not made for them. Yet, despite the space being made with the intent for engineers to collaborate with the goal of growth and career development, mentorship and guidance from subject-matter experts is critical to support career growth.

Additionally the change process could have included more formal communication surrounding the opening of the space. Some survey respondents did not know what the ECDC was or that they had access to it, revealing that the formal communication surrounding the implementation of this space was limited. Although the built environment is often intuitive, it is important to formally communicate what

the space is, what it is intended to be used for, and who can use it. Without this formal communication employees make assumptions one way or another, in this case, contributing to a divide in the overall perception. Also, once the space was opened there was little communication on who the space was for. One baby boomer employee reported that after the space was opened, they noticed one team using the space the most frequently. This individual felt that the space was not for them due to the uncertainty.

Lastly, each generation reads characteristics of the design environment differently. Based on interview data millennials see the overall design as a positive, symbolic change, and should be used for group work, flexible meetings, taking a break when needed. Generation Xers sees the most value in the huddle rooms yet has some hesitations with the space due to how the leadership may perceive them using the space, while baby boomers are less likely to see the purpose of the space or why the space is trying to mix work and play. For example, the all glass facade may reflect transparency and honesty within the organization to millennials, while to baby boomers be seen as being on display and lack of trust in the space. The movable furniture in the space may be seen as flexible and accommodating to millennials, while unpredictable and unreliable to baby boomers. The design elements are giving off different messages, and may be inherently cueing employees of the baby boomer generation that they have less control over the space.

*Company Culture.* Lastly, company culture informs and is informed by the way employees are using their workspace. Company culture can be broken down into the values, norms, and beliefs commonly shared throughout the organization. A few

employees referred to the values that the space reflects. Employees value a division of work and play. The addition of the foosball table in the space negated these values. Similarly, the organization highlights the importance of using time efficiently. One employee commented, "Could you find an extra 20 minutes in your week to walk to another room? With the workload and staffing constraints, walking to this space is not the big rock - it's the air that was displaced." In some ways this statement is similar to the analogy of being too busy driving to stop and get gas. Employees are preoccupied with their daily tasks, however, in some cases, collaborative work and moments of cognitive restoration can be beneficial to an individual's health and their work. In contrast, there are disparities in an individual's underlying values of different areas in the workplace depending on generation. Millennials responded positively toward having amenity spaces and the collaboration space, while baby boomers preferred more of the same or changes relating to ambient conditions and furniture. These preferences confirm that millennials place value on amenities and experiences and are seeking collaboration in the workspace, compared to baby boomers that value benefits and policies over the added amenities.

Similarly, the norms within the workplace etiquette are less established. In some buildings employees speak loudly in the cubical settings, breaking cubicle norms and creating distractions to adjacent employees. Other employees commented on the norms relating specifically to the ECDC. Some mention that employees use the foosball table throughout the day, which to others can be seen as inconsiderate because of the noise produced in the space. It seems that cultural norms around acoustics in the workplace are not consistent. There are not uniform norms on what is

or is not acceptable to do in this space, which tends to take time to reconcile with the development of new spaces.

Other employees shared comments about their underlying beliefs about the organization and how that related to space use. One powerful comment a Generation X employee made revealed the larger beliefs about generational differences in the company,

“The perception of the collaborative work space is that if you are in there, you are not on the clock. It's playtime not work time. Until the baby boomers retire, or management practices change, this room takes up valuable real estate. Management uses the space to identify the next people to receive a layoff notice.”

This perception perpetuates the inhibiting organizational culture. The routes of this perception is unknown but could have stemmed from a single baby boomer who openly expressed their discontent with the space, which then spread to other employees through informal communication means. Even if there is a need for these types of spaces based on the nature of work and individual demand, the organizational culture may dissuade individuals from using the collaboration space.

### 7.3 Organizational Ecology

Additionally the organizational ecology was considered to further understand the relationships with the collaborative space in a wider context. Considerations for policies, work processes, information technologies, and organizational culture helped support the results for both hypothesis. The role of the collaboration space within the workspace is examined in relation to the primary workspace and the overall facility.

Results show that employees who have private offices feel they have the most control over their primary workspaces and feel that the facility meets their needs better than any other group of employees. This returns to the element of control, and also brings up the human need for privacy and territoriality. At an innate level people need to be able to regulate the amount of activity they have in their environment to allow them to do their job in the most efficient and effective manner. Employees in private offices can eliminate external noise from surrounding employees by closing their door; while employees in shared cubicles have greater exposure to external stimuli and greater difficulty in eliminating these distractions from their environment. Therefore it is not surprising that employees in cubicles perceive the ECDC more positively than any other group; for them the ECDC is another location where they can leave their cubicle if they cannot control external stimuli such as privacy levels, and relocate to another space.

On a larger scale, when looking at the relationship employees have to the overall facility, findings show that the work environment has a symbolic meaning. Interestingly, baby boomers felt that the general work environment did not support a range of needs yet millennials requested more accessible elements such as improved elevator access, and more Mothers' rooms. These differences in expectations can be better aligned after opening up the communication between generations. As a first step, it is critical to speak the same language; the meaning of accessibility to baby boomers differs from the way millennials interpret this term. Additionally, employees mentioned the workplace can play a role in connecting an individual to the product, helping to create the intangible feelings of pride and ownership over one's work. This

sense of connection is related to the larger feeling an employee has about the company and perception of their daily work. Building this connection is one way that facilities can have a greater impact on other factors in an organization that may have an effect on company processes as well as organizational culture.

Overall the ECDC is meeting its designed intent by providing a space for engineers to collaborate. However, there is a division between the ways in which employees of different generations use and perceive the space. The next step related to the ECDC would be to bridge this divide to mitigate the negative side-effects through the alignment of change management policies, participatory leadership techniques, and intentional design decisions.



## 8. CONCLUSION

This study revealed generational differences in space use and perception and the contributing factors behind these differences. Overall millennials use the space the most and request more collaborative spaces similar to the ECDC for future facility improvements. Generation X employees place the most value on the huddle rooms within the collaborative space and like the flexibility of having informal unplanned meetings. Baby boomers feel neutral about the collaboration space with only a few advocating for the removal of these types of spaces. Instead they emphasize the importance of the primary workspace. Comparing these three cohorts, millennials use the collaborative space the most and also perceive it the most positively. Results support three key contributing factors for these generational differences: varying levels of perceived control over the collaboration space, the informal and formal communication surrounding the space, and the influence of the company's culture.

Findings also support the role of using the workplace as an asset. Thinking more broadly about the workplace, the role of the workplace is to support employee needs, reflect a symbolic significance of the company, and to create ownership and engagement between the product and employees. At minimum, the workplace should match employee's daily needs. In the Boeing workplace that was studied, employees spend a majority of their time doing independent work, followed by small face-to-face meetings, and scheduled meetings. Therefore the workplace should accommodate primarily independent work, spaces to meet informally with two-four people, followed by spaces for formal, scheduled meetings. On a symbolic level, spaces should reflect the company culture. This includes company values, norms, and beliefs. For example,

The Boeing Company is a leader of innovation so it is important that even the office spaces reflect innovation through the design and policy surrounding space use in order to help build a cohesive corporate culture. Lastly, the work environment can be used as an opportunity to create a stronger relationship between knowledge worker employees and the product they are making. For example, if future facilities included office workers within visibility of the manufacturing facility, or within visibility of the end product, this can help grow the connection between daily knowledge work and the significance of the output.

The ECDC was designed with the intent to create a place for engineers to grow their careers through collaboration. In this sense the space is working well, yet it is clear that in this example the space targets the millennials generation, alienating the baby boomer generation as a side-effect. This is not to say that all collaboration spaces in this work environment would have this outcome or that this current generational gap cannot be bridged, however in bridging this gap it is important to recognize the complexity and significance of these differences and how to use the facility as an asset.

Understanding generational differences is critical because employees are the driving factor that largely determines the success or failure of a company. Employees are also the key stakeholders and end users that shape and are shaped by the workspace. Employees are the decision makers behind policies and budgets. For example, in the ECDC there is a sign posted above the main group table that says, “this space is being monitored.” This signage is a reflection of the company policy and contradicts the intended design of the space. The unintended consequence is that it is

now sending mixed-messages to employees in terms of how they should be using the space, and may be deterring them from breaking an untraditional business practices. If a policy gives employees the message that they should not break away from company standards, there is no room to innovate. With the increased global competition and accessibility to markets, a company that does not innovate will not succeed. Policy decisions are also closely linked to the larger organizational ecology, as a key driver of culture and employee behavior. Additionally, having groups of employees clash with other groups can amount to lost hours of productivity, lead to mistakes from miscommunication between teams, and cost thousands of dollars for attracting and retaining new employees if employees are dissatisfied with their work and the company.

Similarly, the workplace is important because it can facilitate or deter different behaviors, which can either support the type of work happening in the space or make it more difficult. For example, there is a team of engineers at The Boeing Company who needs to collaborate and communicate with each other on a daily basis for their projects. This team is assigned to sit in a row of cubicles. The environment is telling them they should communicate through their computers while sitting at their desks, but had their primary work arrangement be a group setting without partitions, their environment would be telling them to communicate verbally, which may actually be much more efficient and effective for the nature of their work. A good workspace design goes unnoticed, yet a poor design can be an added barrier to completing daily work tasks. The workplace is the stage for all of the other aspects of an organization to

unite. It is up to the organization of how they want to set their stage to facilitate intergenerational communication within employees.

In order to bridge the generational divide between employee perceptions of collaboration spaces, I recommend strategically aligning change management processes, participatory leadership styles, and intentional facility design. In terms of change management, the processes surrounding a change in a facility or the addition of a new facility should consider communication before, during, and after a change. Before a facility change is made there should be open communication with all stakeholders involved. This will allow opportunity for some of the user groups to provide feedback and become aware of how their spaces are changing as well as why. While the space is being renovated and nearing completion, there should be increased formal communication about what the space is used for and who can use the space. Additionally once the facility change is completed there should be a continuation of the change management process. Programmed events in the space can help employees see what the space is used for and how to use it, supporting a healthy transition into the space and simultaneously transitioning company culture.

Participatory leadership strategies overlap with change management processes. Although leading by example is not a new idea, it can be incredibly powerful especially when going through any company changes. Leadership has the responsibility to communicate why new facility changes are important and to help establish formal workplace norms surrounding time allocation and how to use new space typologies.

Lastly, future facility designs should all include intentional design decisions

with generational differences in mind. Facilities should design out barriers. This stems from the findings that different generations may be more comfortable with the flexible nature of technology in collaborative spaces. Creating future spaces include seamless technology and furniture that supports an easy transition between an employee's primary workspace and the collaboration space. This follows closely with the recommendation for “designed Déjà vu.” Designed déjà vu the premise that spaces should include a sense of familiarity with many of the design elements and the space overall in order to support intuitive space use. Additionally, spaces should be designed for communication. The design of the space needs to speak the same language to all employees. For example, a space with all glass walls may be thought of as innovative for millennials but seen as an invasion of privacy to baby boomers. It is important to think about how change management and leadership can bridge these differences throughout the design process. With this in mind, the design identity of a space can also be crafted to match company culture and create a more unified meeting of the space for all generations.

Aligning these factors is critical to address the challenge of a generational divide in the workplace. The alternative may only perpetuate the ongoing challenge of building a positive and united company culture. Planning strategically for the key aspects underlying the relationship between the facility and workforce will contribute to a harmonization of the organizational ecology.

## 9. LIMITATIONS

Possible limitations in this research stem from the case study methodology. Case study designs are specific to the population and context being studied at that time, making these results unable to be replicated precisely. The contextual nature of case study research may contribute to low external validity. The responses from the employees participating in this study do not represent the response type for all Boeing employees at the sites sampled. For example, there may be a population bias for the participants that decided to respond to the survey. The survey response rate did not reach the entire population of the Philadelphia site and therefore there is a chance that those who choose to complete the survey felt strongly for or against responding to a “Collaboration Space Survey”. The responses from interviews and surveys were from a sample of the population; therefore it is unclear whether these findings would generalize to the greater Boeing population. Additionally, this study is not generalizable beyond Boeing due to the variety of contextual factors weighed into the case study.

There are also limitations inherent to the human component of research. Conducting ethnographic case study research over two years can lead to difficulties in parsing out personal experiences and connections to eliminate researcher bias. There is potential for researcher bias that comes with developing a perspective after building a relationship with Boeing employees through this research experience. Additionally due to the high security within the company, employees were not always willing to share their opinions on certain topics.

## 10. IMPLICATIONS FOR FUTURE RESEARCH

Future research could expand upon generational differences and the environment, the underlying contributing factors to the generational divide, and the role of the primary workspace. Generational differences could be explored further by looking at other space typologies. A similar research methodology could be used to determine facility outcomes of other space typologies to measure how well they are meeting the needs of their users. Pre-occupancy and post-occupancy measures of spaces could be regularly integrated into facility practices to engage employees with facility improvements and evaluate these improvements to test how well the facility is being used as a resource to employees. These practices would be beneficial to evaluate future ECDC throughout Boeing. Research could also look beyond Boeing to other industries or beyond the work environment such as community spaces, homes, or third places.

Additionally, future studies could also explore the underlying contributing factors that this research identified. Research could expand upon the level of control by studying how to better design for the need for control in a work environment. The role of communication with design could also be examined. This could include deciphering the balance of communication within change management, and determining which channels are the most effective means when making design changes. Additionally, corporate culture as a barrier to using spaces could be researched to understand to what degree leadership plays a role and the level of influence leaders have throughout this process.

Lastly, this research has created the foundation to examine the relationship between primary and secondary spaces within the workplace. Further research could be conducted to help determine the balance between primary and secondary spaces in an office and how to optimize each depending on the industry. This could help identify the underlying factors that push an employee to leave their primary space and use another space. Future studies in these areas would allow facility planning take an evidence-based design approach to strategically planning for future improvements.



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## APPENDIX A

### Survey Questions

#### Nature of Work

- I. Where do you primarily work?
  - A. Building A
  - B. Building B
  - C. Building C
  - D. Other
- II. How do you identify yourself as?
  - A. Introvert
  - B. Extrovert
- III. Which generation do you identify with?
  - A. Millennial (born 1980s -1990s)
  - B. Generation X (born 1960s - mid 1970s)
  - C. Baby Boomer (born 1940s -mid 1960s)
- IV. What is your primary work setting?
  - A. Shared Cubicle
  - B. Individual Cubicle
  - C. Shared Office
  - D. Private Office
  - E. Work Remotely
  - F. Mobile/Hoteling
  - G. Other: \_\_\_\_\_
- V. Please indicate to what extent you agree or disagree with the following statements, according to your experience in your primary work setting. (1-7 *Likert scale*)
  - A. My primary work setting....
    1. Can accommodate meetings with colleagues.
    2. Supports work that requires concentration.
    3. Provides sufficient visual privacy.
    4. Provides sufficient acoustic privacy.
    5. Has technology that supports solo work.
    6. Has an arrangement and furnishings that supports solo work.
    7. Allows me to control my work environment.
- VI. In a typical work week, please indicate the activity you spend the most time on, second most time on, and third most time on:
  - A. Working by yourself on computer (excluding conference calls or video conferences)
  - B. Working by yourself using physical materials (paper, book, whiteboard, etc.)
  - C. Conference calls or video conferences where no one else is physically in the room with you

- D. Scheduled meetings with at least one colleague physically participating with you
- E. Unscheduled collaborative work (face-to-face)
- F. Casual conversations with colleagues (face-to-face)
- VII. Where do in-person meetings with colleagues take place?
  - A. In your own workspace or someone else's workspace
  - B. In a conference room or meeting space
  - C. The ECDC
  - D. At other locations in the building, please indicate location(s): \_\_\_\_\_
  - E. N/A only virtual, please indicate locations(s): \_\_\_\_\_

#### Satisfaction with Facility Improvements

- VIII. Have you ever used the ECDC in building B?
  - A. Yes
  - B. No
- IX. Please select the reason(s) for why you choose to use the ECDC:
  - A. It's in a convenient location
  - B. I like to work near other people
  - C. I have primarily group work
  - D. I like the resources available (whiteboards, flexible seating, etc.)
  - E. I don't use the space very much
- X. Please indicate to what extent you agree or disagree with the following statements, according to your experience using the ECDC on the first floor of 3-04. *(1-7 Likert scale)*
  - A. In the ECDC...
    - 1. I can always find a place to have a meeting when I need it, whether reserved in advance or not.
    - 2. The arrangement and furnishing of meeting spaces supports meeting effectiveness.
    - 3. The technology and other features (e.g., whiteboards) in meeting spaces support meeting effectiveness.
    - 4. The meeting spaces that I use can provide sufficient privacy if needed.
    - 5. There are suitable places for the types of collaborative work, meetings, or conversations necessary for my work.
    - 6. I have control over the setting to fit my needs
- XI. Please indicate to what extent you agree or disagree with the following statements, according to your experience in your current work environment. *(1-7 Likert scale)*
  - A. Overall...
    - 1. There is adequate accommodation for disabilities and special needs (e.g. by nursing mothers) in this building.
    - 2. In general, the spaces in this building support my work.
- XII. Which facility improvement do you like the most, or works the best for you? *(open-ended response)*



XIII. What improvements or changes would you like to see in the facility?  
(*open-ended response*)

## APPENDIX B

### Interview Questions

#### Introduction

1. Tell me about what your role is here.
2. Tell me about your day-to-day work.
  - a. Do you enjoy it?

#### Collaborative Work

3. How often do you have collaborative work?
  - a. Are there any barriers to collaboration?
4. What're your thoughts on the ECDC?
  - a. Do you use it?
  - b. Why/Why not?

#### Perception of the General Space

5. What are your thoughts on the actual workspace?
6. What could be improved?
7. How important do you think the workplace is?
  - a. What is your relationship to the workplace?

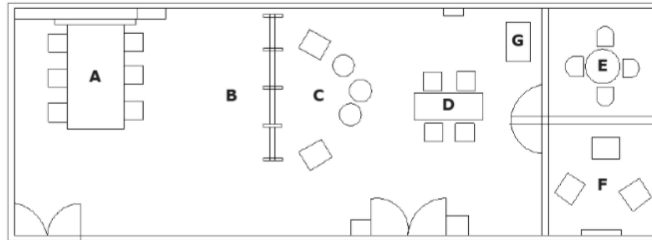
#### Perception of the Company

8. How do you feel about Boeing in general?
9. Do you think you will come back full time?
  - a. Why/why not?

## APPENDIX C

### Interaction Log Example

#### FLOORPLAN:



Time	8:00am
How many people are in the space?	3
What primary activities are going on?	Using laptops for group work
Where are employees in the room?	A
What resources are used to support this activity?	Laptops and monitor
Additional notes (i.e. generational differences, one person/ one group repeatedly in the space).	All Generation X or younger